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Extensive, high-quality, low-frequency acoustic scattering data were collected on the Acoustic Reverberation Special Research Program (ARSRP) Reconnaissance Cruise just west of the Mid-Atlantic Ridge in the summer of 1991. In its original form on HDRR or OLP (Off-lint Processor 9-track) tapes, this important data set is not readily accessible. Based on software written by us in PV-Wave, as well as some modified Scripps software in C language, we have developed and documented an processing system we call ASPS ["ARSRP Signal Processing Software," L. A. Pflug, J. W. Caruthers, and R. R. Slater, NRL/MR/7173--92-7004, Feb. 93]. We have applied this processing to data from ARSRP-selected Sites A and C. Site A is a priority site for future fine-scale work and C is a site alternate to other priority sites. Presented here are displays of scattering data for these two sites with some interpretation and analysis. In addition to the displays of these data, we have made an Exabyte tape containing the relevant parts of pings impinging on these sites. A copy of this tape is available to ARSRP participants.

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ACOUSTIC BACKSCATTERING AT ARSRP SITES A AND C

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ABSTRACT

Extensive, high-quality, low-frequency acoustic scattering data were collected on the Acoustic Reverberation Special Research Program (ARSRP) Reconnaissance Cruise just west of the Mid-Atlantic Ridge in the summer of 1991. In its original form on HDDR or OLP (Off-line Processor 9-track) tapes, this important data set is not readily accessible. Based on software written by us in PV-Wave, as well as some modified Scripps software in C language, we have developed and documented a processing system we call ASPS ["ARSRP Signal Processing Software," L.A. Pflug, J.W. Caruthers, and R.R. Slater, NRL/MR/7173-92-7004, Feb 93]. We have applied this processing to data from ARSRP-selected Sites A and C. Site A is a priority site for future fine-scale work and C is a site alternate to other priority sites. Presented here are displays of scattering data for these two sites with some interpretation and analysis. In addition to the displays of these data, we have made an Exabyte tape containing the relevant parts of pings impinging on these sites. A copy of this tape is available to ARSRP participants.

INTRODUCTION

Low-frequency acoustic scattering data were collected on the Acoustic Reverberation Special Research Program (ARSRP) Reconnaissance Cruise on the western flank of the Mid-Atlantic Ridge in the summer of 1991. Information about the experiment is documented in the Acoustic Reverberation Special Research Program Initial Report of 19 August 1991 [1]. (We assume here that the reader is an ARSRP participant and generally familiar with the experiment; other readers should refer to ref. [1] or other ARSRP reports.) Several pings (notably pings 190 and 191) have been investigated extensively, but due to their limited availability and/or accessibility, numerous other relevant pings have been neglected. We attempt here to make additional pings available to the ARSRP community for further processing. These new pings are listed in Table I.

A geological and geophysical (G&G) survey was conducted aboard the R/V Maurice Ewing in the summer of 1991. In the summer of 1993, fine-scale acoustics and G&G cruises to selected sites in the same region are planned. Based on the previous reconn and G&G cruises, several sites were selected and planned for the detailed work in this summer's cruises. Among these sites are the ARSRP-designated Sites A and C. Site A is a priority site for the future fine-scale work and C is a site alternate to other priority sites. Presented here are reverberation displays of relevant

Table I: Ping locations.

PING	LONG.	LAT.
188	46.117	26.160
189	46.130	26.169
198	46.258	26.255
199	46.271	26.263
247	46.283	26.258
257	46.384	26.182

acoustic data for these two sites with some interpretation and analysis. Interpretation of geophysical data for these sites is provided in the accompanying paper "Geology and Geophysics at ARSRP Sites A and C" [2]. This summary will serve as a reference during the execution of the fine-scale acoustics reverberation experiments at Sites A and C.

Software written in PV-Wave, Version 3.0, is used to process ARSRP reconn data used in this work [3]. This software is referred to as the ARSRP Signal Processing Software (ASPS) and was designed to reproduce real-time processing done during the experiment using a software system aboard the Cory referred to as the Monitoring Support Software (MSS) [4]. (Processing done by MSS was done in real time for display only; it was not available subsequently for additional analysis.) ASPS software includes reading SEGY format archive tapes into ASCII format, conversion of ASCII data files to unformatted form for compact storage and fast access by PV-Wave, and beamforming and matched filtering with PV-Wave programs. A program to create waterfall display plots similiar to MSS plots of hydrophone data, beamformed data, or matched filtered data is included.

LOW-FREQUENCY REVERBERATION AT SITES A AND C

Figure 1 is a map of the bathymetry in the area around Sites A (26°07.2'N 46°13.9'W) and C (26°16.4'N 46°30.0'W). Also shown in the map are some of the pings that have energy impinging on the sites. Pings that are labelled by a ping number are the pings that are displayed and discussed here. An attempt was made to process some of the eight pings (four on run 9 and four on run 11) displayed to the left of Site C in Fig. 1. Unfortunately, the 9-

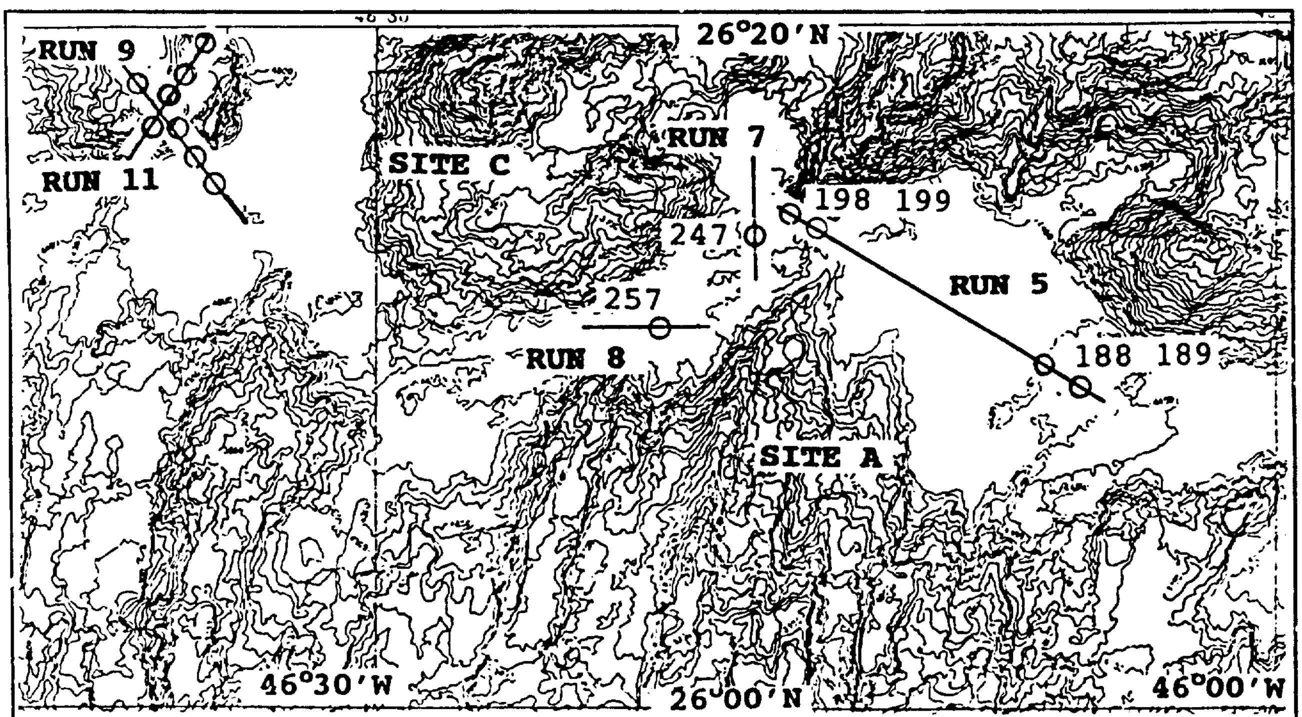

Figure 1: Bathymetry and ping locations (in UTM) for the regions of Sites A and C.

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track OLP tapes containing these pings had some flaws in them, and we were unable to read valid data from them. It is likely, however, that good data for these eight pings do exist on HDDR tapes.

Since the pings discussed here have not been previously processed, they are displayed to shed new light on the scattering process. The data format for each of these pings is C (all phones), so these data are higher resolution than the standard format A (half phones and half beams). In one set of graphics (Fig. 2, 3, and 4) we show the full set of 126 beams that are formed by the ASPS software and match filtered with waveform SPSS053 [1,3]. The channel/beam conversion varies slight from the

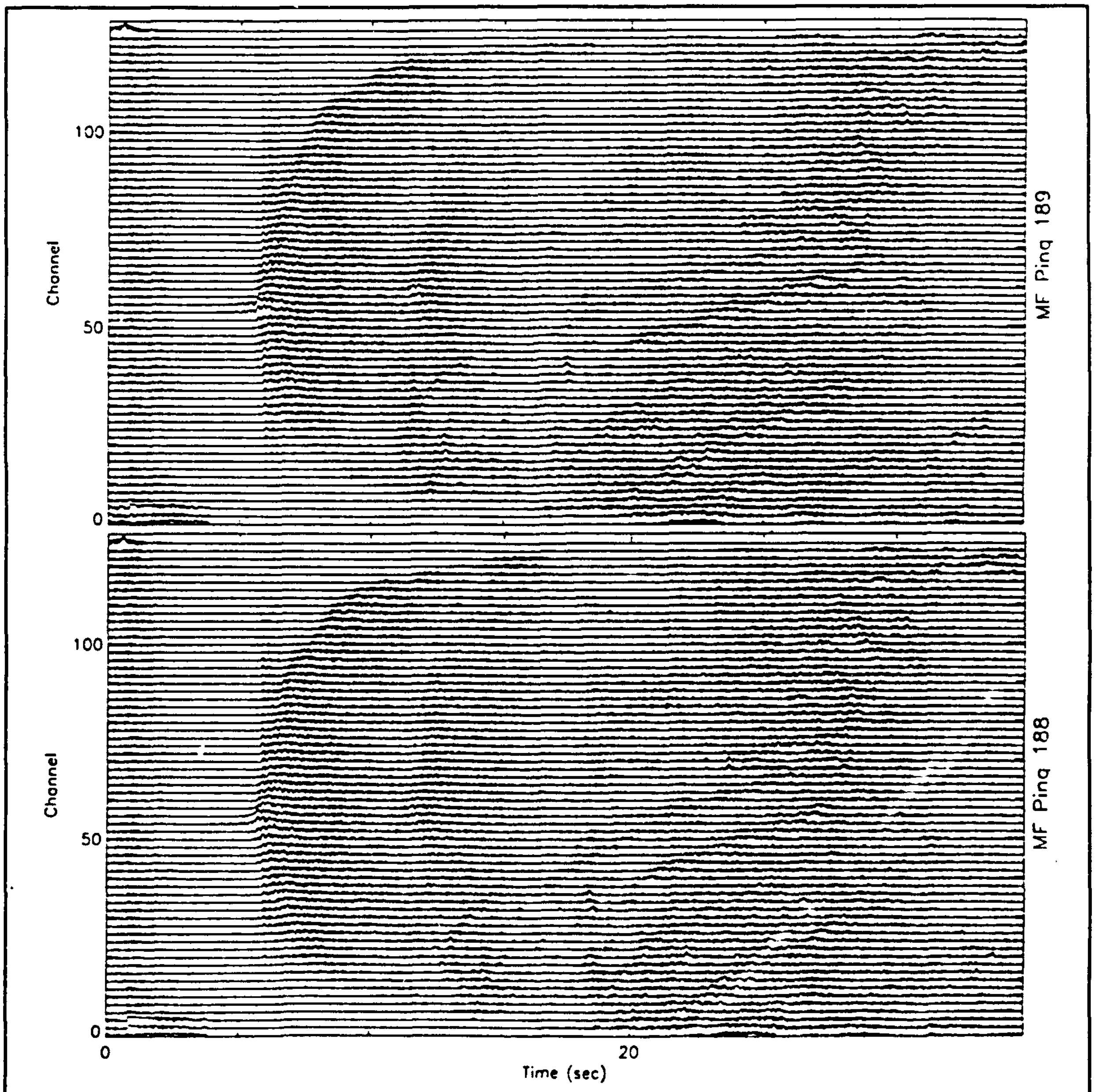

Figure 2: Scattering in a full 180° sector from pings 188 and 189.

that given in the cruise report [1,4]; here they are based on a constant cosine increment of 0.0160 covering 0° (endfire forward) to 180° (endfire aft).

Figure 2 displays scattering in the 180° about the horizontal line array for pings 188 and 189. These two pings are on run 5 and occurred on Julian Day (JD) 218 at 0918Z and 0933Z, respectively. The previously analyzed pings 190 and 191 occurred JD 218 at 0948Z and 1003Z, respectively. The linear structure seen in the scattering for 188 and 189 is the same seen in 190 and 191 [4,6,7]. The heading of the array was about 306° and ridges can be located in the seafloor on the left side of the array corresponding to lineations in the observed data [2]. Undoubtedly, there is

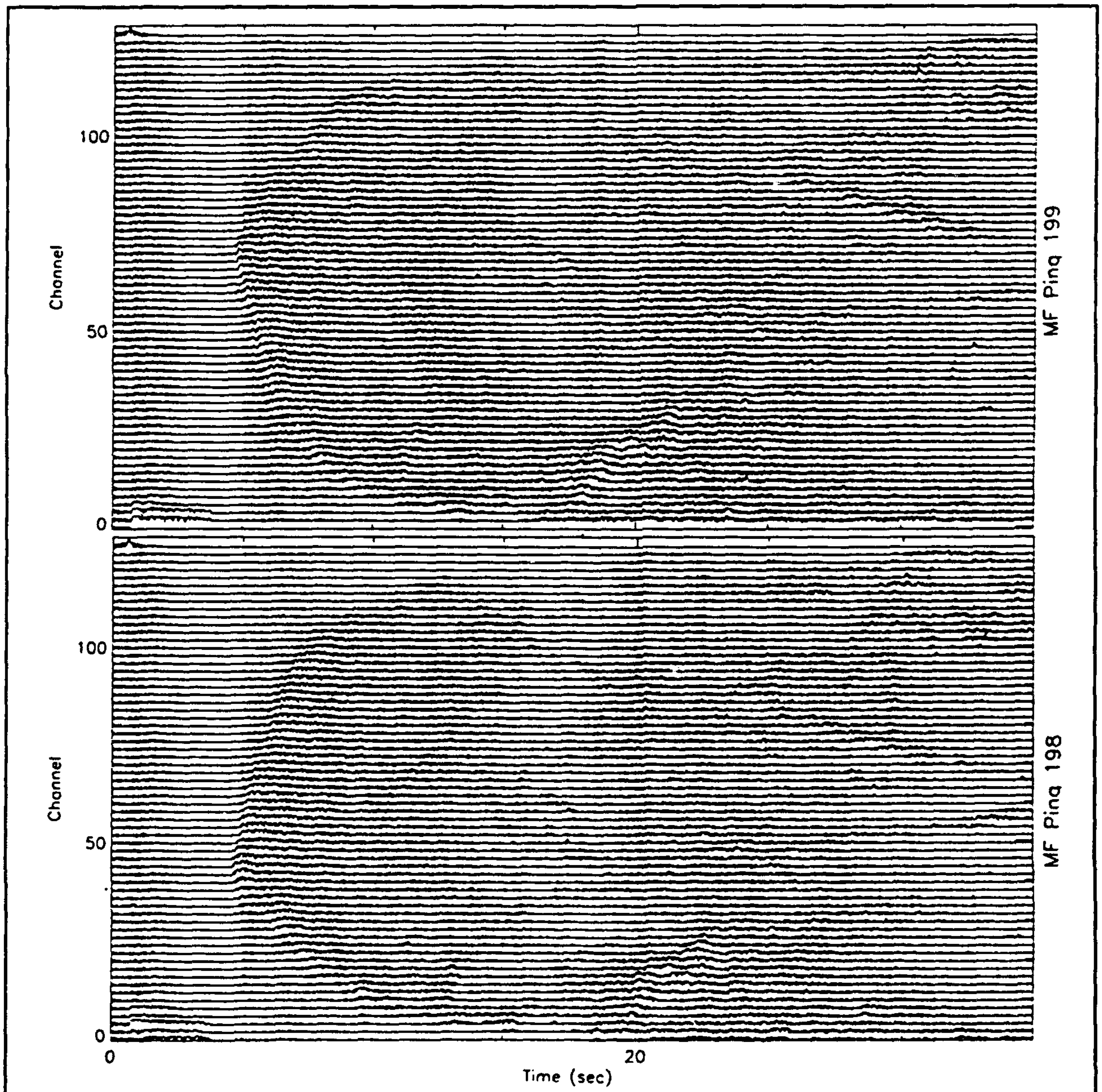

Figure 3: Scattering in a full 180° sector from pings 198 and 199.

scattering coming from the right side of the array also, but the structure observed is clearly that on the left. The scattering from the pinnacle that had been reported from several pings on run 5 is clearly visible in 188 (channel 34 at 18 sec) and 189 (channel 38 at 17.5 sec). Ping 188 (0918Z) has been displayed as MSS plots previously based on low-resolution beamforming (64 phones) [4].

Figure 3 displays ping 198 (JD 218 1203Z) and 199 (JD 218 1218Z), also on run 5 with an array heading of 306°. These two pings have been displayed as MSS plots previously based on high resolution beamforming (126 phones) [4], but the data is now available for additional processing. The interesting point in these data is that, in the beam/time plots, the lineations just

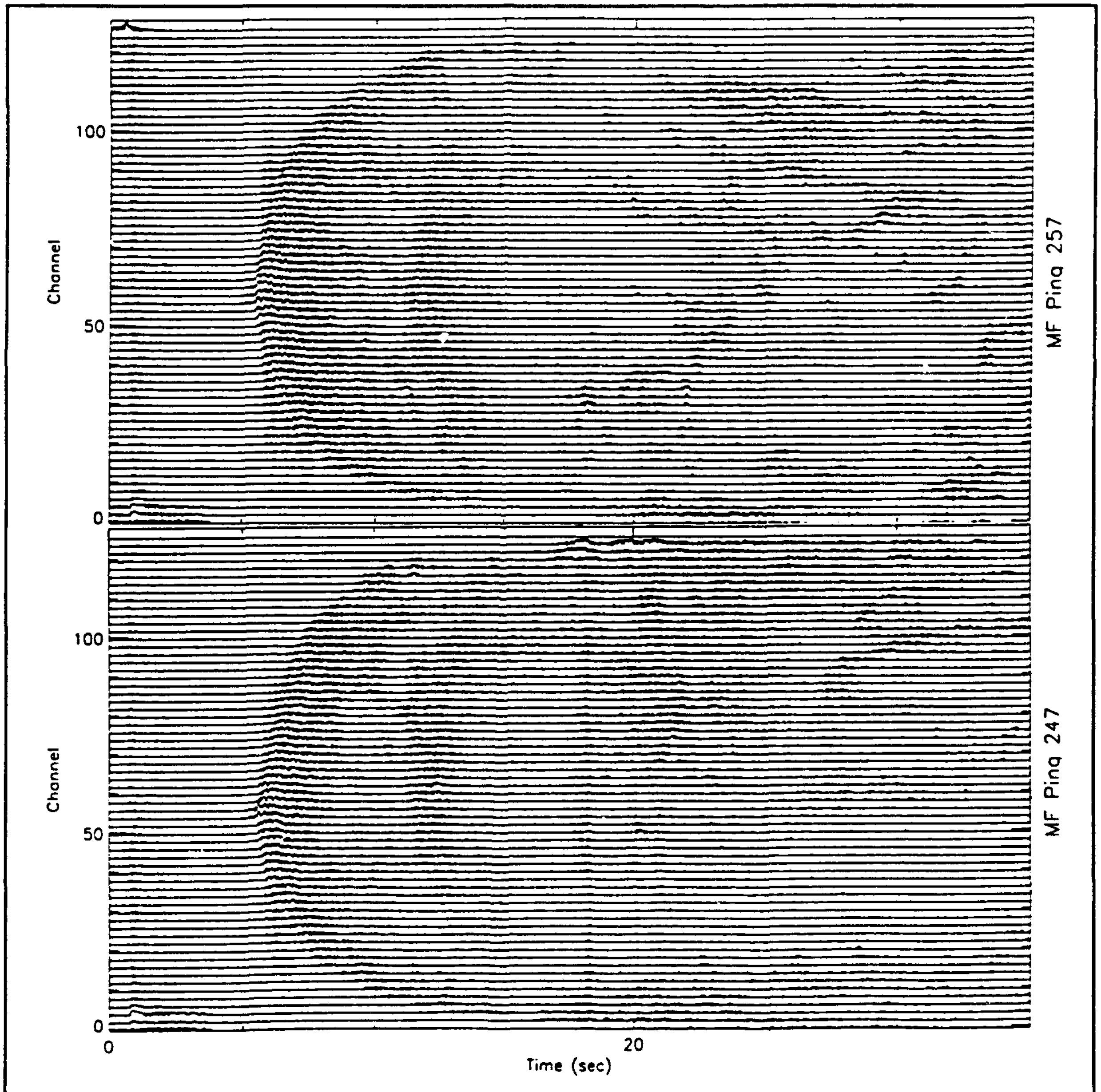

Figure 4: Scattering in a full 180° sector from pings 247 and 257.

before and just after channel 62 (approximately broadside) appear to reverse directions. It is likely that these ridges are parallel and their appearance in the beam/time display is a natural geometric consequence of the possibility that one ridge is ahead of the array broadside and the other is behind. As we shall see latter it is likely that the ridges behind the array are in the area of Site A. It is also likely, however, that it is the back sides of the ridges that are ensonified.

Figure 4 displays a ping on run 7 (247) and one on run 8 (257). Both have energy that is impinging on the back sides of the ridges at Site A. Run 7 and 8 are headed approximately due South and due West, respectively. It is interesting to note that for ping 247 there is a wide range of angles in the forward direction (channels 16 to 50) that both the ambiguous beams are hitting a sedimented pond. There are not many places in the reconn data set for which this is true. It is clearly observed that scattering from the ponds in these beams is very weak. The ponds are characterized by both a smoother surface and a weaker impedance contrast than the ridge area, and these are the likely reasons for the weaker scatter.

In each of Fig. 2,3, and 4 the position of Site A can be located. The approximate location of its center in each scatter plot is given in Table II. (Every other beam is skipped in the figures.)

Table II: Site A ref Ping.

PING	TIME	ANGLE	BM#
188	17.4	56.6	28
189	16.4	63.4	35
198	21.1	135.4	107
199	22.5	139.4	110
247	22.3	20.0	4
257	23.1	155.3	119

ACKNOWLEDGEMENTS

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